

ZERO WIRE® DUO

High-Definition Wireless Video System

ZeroWire®

USER MANUAL

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CAUTION



This symbol alerts the user that important literature concerning the operation of this unit has been included. Therefore, it should be read carefully in order to avoid potential problems.



This symbol warns user that un-insulated voltage within the unit may have sufficient magnitude to cause electrical shock. Therefore, it is dangerous to make contact with any part inside the unit. To reduce the risk of electric shock, **DO NOT** remove cover (or back). ***There are no user serviceable parts inside.*** If you experience problems with this device, please contact your supplier.

To prevent fire or shock hazards, do not expose this unit to rain or moisture. Also, do not use this unit's polarized plug with an extension cord receptacle or other outlets unless the prongs can be fully inserted. The device is designed to meet the medical safety requirements for a patient vicinity device. This device **may not** be used in connection with life support equipment.



Safety Compliance:

This device is T.U.V. approved WITH RESPECT TO ELECTRIC SHOCK, FIRE AND MECHANICAL HAZARDS ONLY IN ACCORDANCE WITH UL 60601-1/CAN/CSA C22.2 NO. 601.1.



Safety Compliance:

This device meets the requirements of EN-60601-1 so as to conform to the Medical Device Directive 93/42/EEC and 2007/47/EC (general safety information).

FCC Identification:

UEZTQM7201



Radio Approval:

This device meets the requirements of EN 302 065 V1.2.1 and conforms to Radio and Telecommunications Terminal Equipment (R&TTE) Directive 1999/5/EC.

This device complies to the above standards **only** when used with the supplied medical grade power supply.

Standard Power Supply:

24 Volt: Ault MW172KB2400F02 or Ault MW172KB2400B02

The device should be powered from a center tapped circuit when used in the US at voltages over 120 volts. This product is intended for continuous operation.

Recycling:



Follow local governing ordinances and recycling plans regarding the recycling or disposal of this equipment, or contact the Electronic Industries Alliance (www.eiae.org)

Declarations of Conformity

FCC and Council Directives of European Standards:

This device complies with Part 15 of FCC rules and 93/42/EEC and 2007/47/EC of the Council Directives of European Standards. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesirable results.

1. Use the attached specified cables with the device so as not to interfere with radio and television reception. Use of other cable and adapters may cause interference with other electronic equipment.
2. This equipment has been tested and found to comply with the limits pursuant to FCC part 15 and CISPR 11. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

IEC:

This equipment has been tested and found to comply with the limits for medical devices to the IEC 60601-1-2. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to other devices in the vicinity.

FCC, Council Directives of European Standards and IEC:

There is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the transmitter and / or the receiver.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult your dealer or an experienced radio/TV technician for help.

Accessory equipment connected to this device must be certified according to the respective IEC Standards, i.e. IEC 60950-1, for data processing equipment and IEC 60601-1 for medical equipment. Furthermore, all configurations shall comply with the system standard, IEC 60601-1-1. Anyone who connects additional equipment to the signal input part or signal output part configures a medical system, and is therefore responsible that the system complies with the requirements of system standard IEC 60601-1-1. Whoever is responsible for securing the device to a system needs to insure that the mounting equipment used with this device complies to IEC standard 60601-1. If in doubt, consult with your vendor's technical service department.

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Customers are cautioned that system configuration, software, the application, customer data and operator control of the system, among other factors, affect the product's performance. While NDS products are considered to be compatible with many systems, specific functional implementation by customers may vary. Therefore, suitability of a product for a specific purpose or application must be determined by the consumer and is not warranted by NDS.

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About This Manual

This manual is designed to assist the user with installation, setup and operation of the NDS ZeroWire® Duo HD wireless video system.

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A blue numbered tab on the side of the page denotes the beginning of a section.

The functional descriptions in this manual are representative of:

Part Numbers:

90T2014 = Receiver

90T2015 = Transmitter (Input: DVI)

90T2016 = Transmitter (Input: DVI and 3G-SDI)

Manual Part Number: 60G0374 Rev F

Indication for Use

The NDSsi ZeroWire Duo HD Wireless Video System is a paired transmitter and receiver, intended for delivery of video signals over a radio-frequency link to a video display during endoscopic and general surgical procedures. The ZeroWire HD Wireless Video System is a non-sterile reusable device not intended for use in the sterile field. It is intended for use by qualified physicians having complete knowledge of these surgical procedures.

Contraindications:

1. These units are non-sterile reusable devices and are not intended for use within a sterile field.
2. This equipment may not be used in the presence of flammable anesthetics mixture with air, oxygen or nitrous oxide.



For mission critical applications, a replacement DVI cable and a BNC terminated coaxial cable shall be immediately available.

Overview

The ZeroWire Duo transmitter and receiver pair allows wireless delivery of video signals from the DVI or HD-SDI output of an endoscopic camera processor or other video source to the DVI input of a video display. It operates as an unlicensed ultra-wideband (UWB) wireless system in compliance with FCC (Part 15) rules governing UWB.

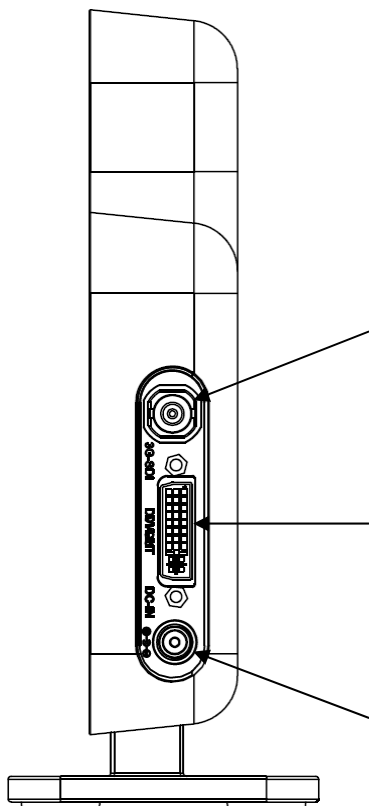
The system is composed of a transmitter (Tx) and a receiver (Rx) pair. The Tx unit is designed to be mounted on the rear top edge of a display on a surgical cart, or on the cart itself. The transmitter may obtain its input video signal from either an endoscopic camera processor or the display's re-drive output. The Tx unit is powered from the provided 24 VDC power supply ("wall-wart") or through the optional 'Y' adapter cable*. The 'Y' adapter cable is described on page 6.

The Rx unit is designed to be mounted on the rear top edge of a display, it may also be mounted on a cart, and is powered from the provided 24 VDC power supply ("wall-wart") or through the optional 'Y' adapter cable*. The 'Y' adapter cable is described on page 6.

A typical installation is shown on page 9.

***Note:** The 'Y' adapter cable is for use with NDS 19", 24", 26" and 32" Radiance and 24" EndoVue displays only.

ZeroWire Transmitter (Tx)



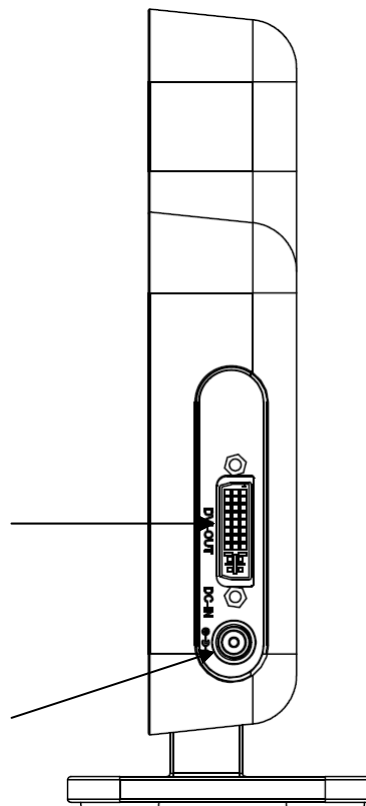
3G- SDI input (90T2016 only)

DVI input

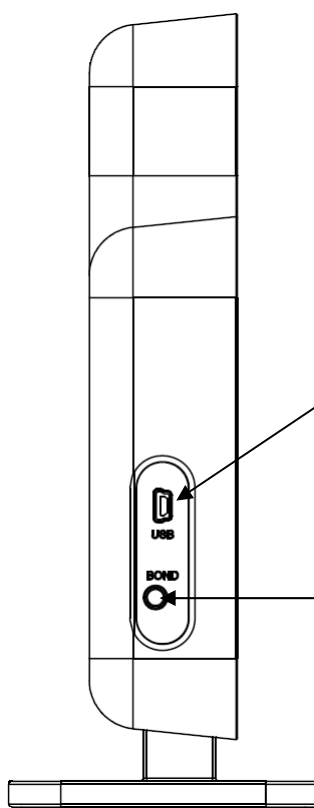
DVI output

Power connector

ZeroWire Receiver (Rx)



Tx & Rx Common Connectors



The USB port is used for installing updates to the Tx or Rx firmware. It is not a general purpose I/O port

The BOND button allows the bonding of a transmitter to a receiver.

Installation

Mounting Options:

24" and 26" Radiance Displays :

Each step bracket is stamped with a part number (P/N). For **Radiance 24"** and **26"** displays, select step bracket P/N 20C0660. Replace the left hand mounting screws with 2 of the provided mounting screws, do not tighten them. Remove the two right hand screws from the VESA mount. With the side stamped FRONT facing the front of the display, slide the step bracket between the VESA mount and the back of the display until notches labeled for the display you are working with fit over the two left hand screws. Replace the right hand screws with the screws provided and tighten all screws. With the black surface of a ZeroWire Rx or Tx module facing the front of the display, align the slot on the bottom of the module with the top of the bracket and push the module down on the bracket until the module seats.

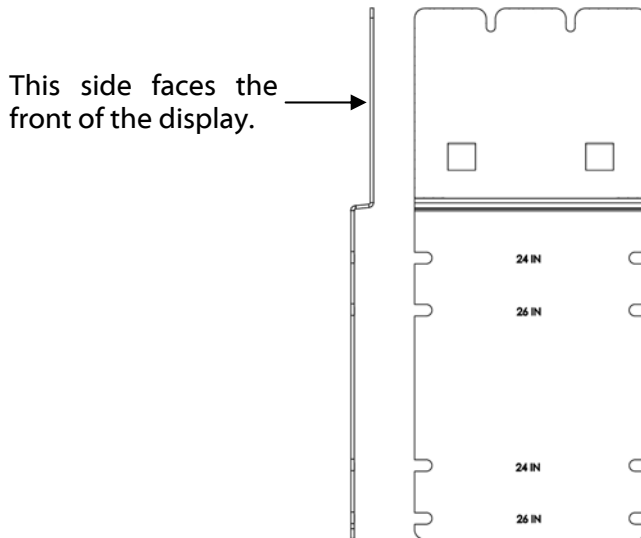
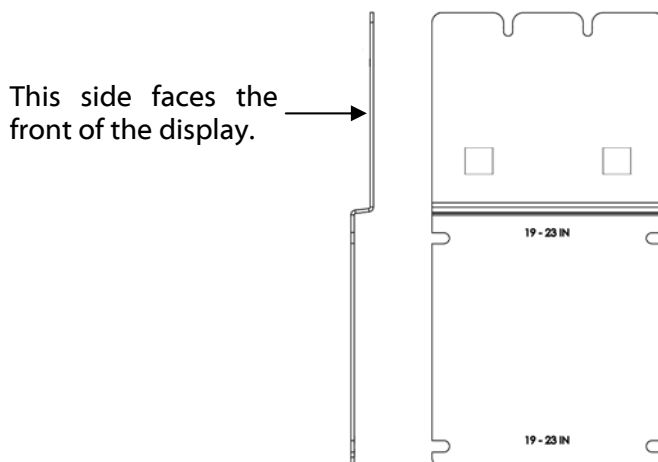


Figure 1.
Typical ZeroWire installation on a NDS
Radiance 26.

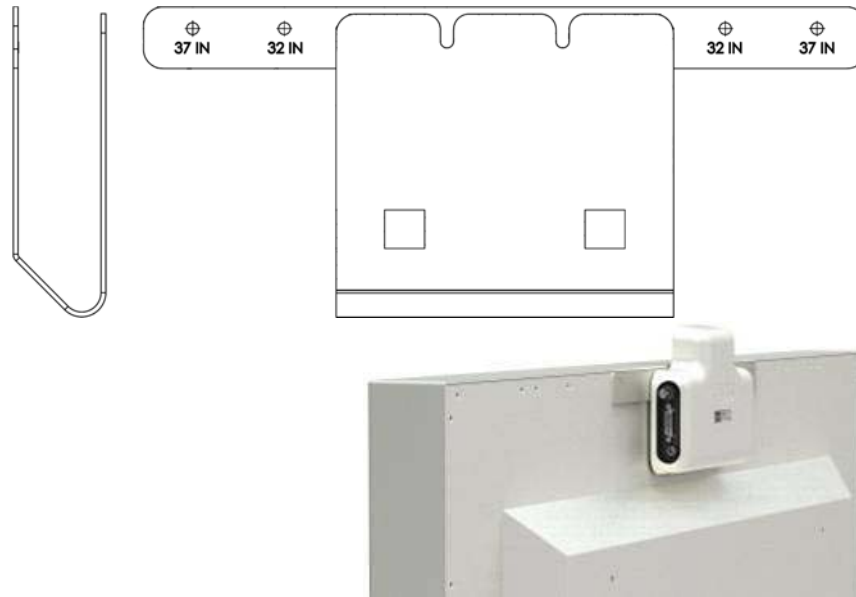
19" and 23" Radiance and 24" EndoVue Display:

Each step bracket is stamped with a part number (P/N). For **Radiance 19"** and **23"** and **EndoVue 24"** displays, select step bracket P/N 20C0683. Replace the left hand mounting screws with 2 of the provided mounting screws, do not tighten them. Remove the two right hand screws from the VESA mount. With the side stamped FRONT facing the front of the display, slide the step bracket between the VESA mount and the back of the display until notches labeled for the display you are working with fit over the two left hand screws. Replace the right hand screws with the screws provided and tighten all screws. With the black surface of a ZeroWire Rx or Tx module facing the front of the display, align the slot on the bottom of the module with the top of the bracket and push the module down on the bracket until the module seats. The completed assembly will look like Figure 1 above.



32" and 37" Radiance Displays:

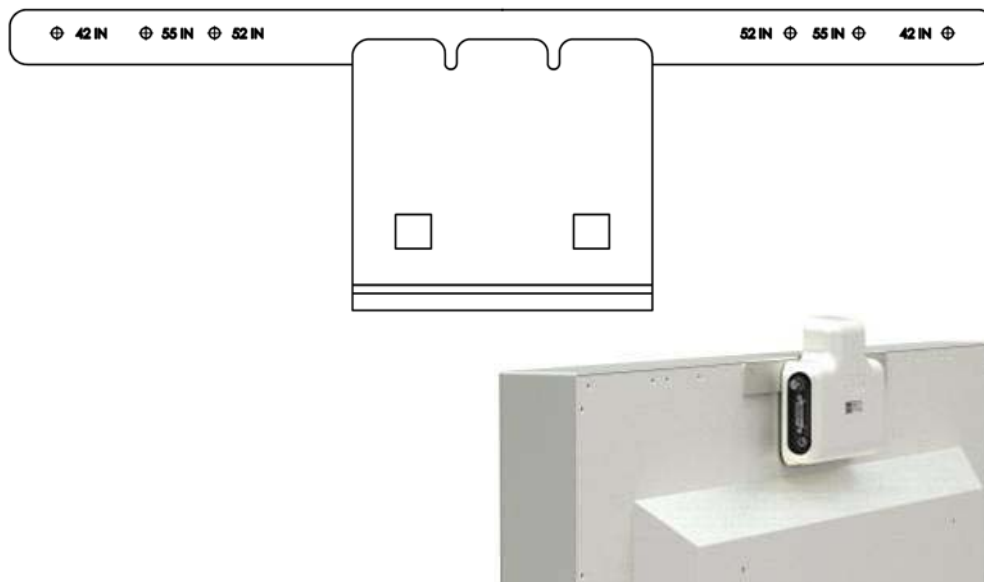
Select 'T' bracket (P/N 20C0684). Lay the display face down on a clean surface. Center the 'T' bracket on the top edge of the display and remove the 2 screws that are aligned with the holes in the bracket. Insert the provided screws through the bracket and case back. Tighten both screws. With the black surface of a ZeroWire Rx or Tx module facing the front of the display, align the slot on the bottom of the module with the top of the bracket and push the module down on the bracket until the module seats.



Typical ZeroWire installation on a NDS Radiance 37.

42", 52" and 55" Radiance Displays:

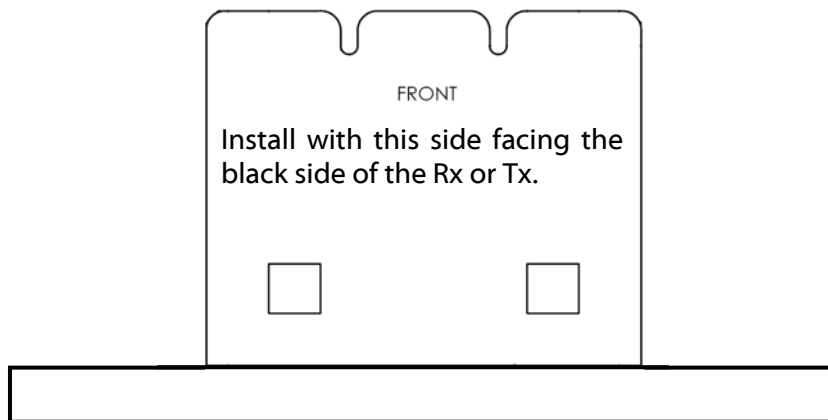
Select 'T' bracket (P/N 20C0668). Lay the display face down on a clean surface. Center the 'T' bracket on the top edge of the display and remove the 2 screws that are aligned with the holes in the bracket. Insert the provided screws through the bracket and case back. Tighten both screws. With the black surface of a ZeroWire Rx or Tx module facing the front of the display, align the slot on the bottom of the module with the top of the bracket and push the module down on the bracket until the module seats.



Typical ZeroWire installation on a NDS Radiance 42.

Desktop:

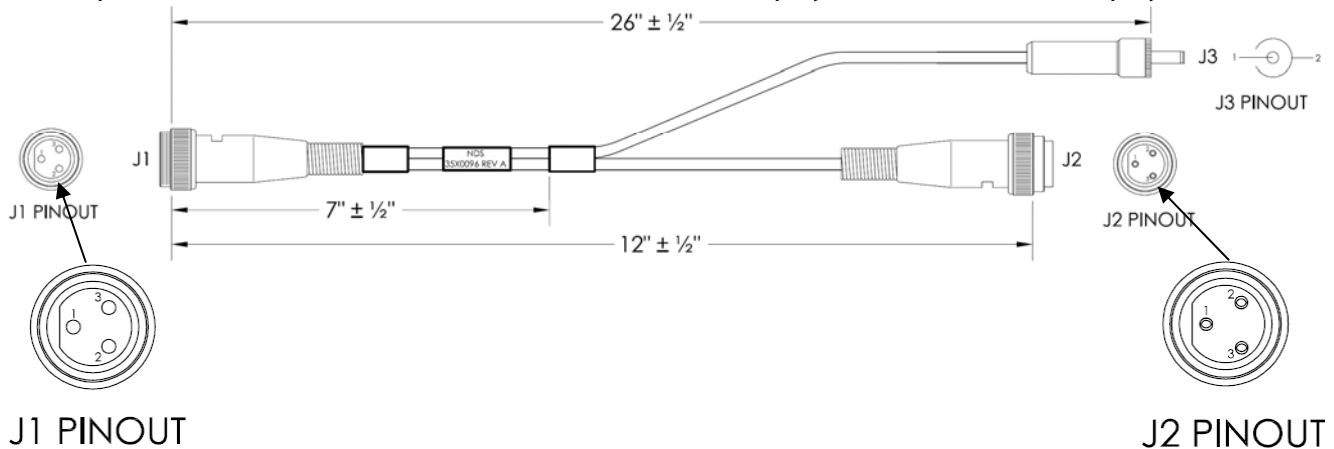
With the side stamped FRONT and the black surface of a ZeroWire Rx or Tx module facing you, insert the desktop mount into the slot in the bottom of the module and push downwards on the mount until the module seats.



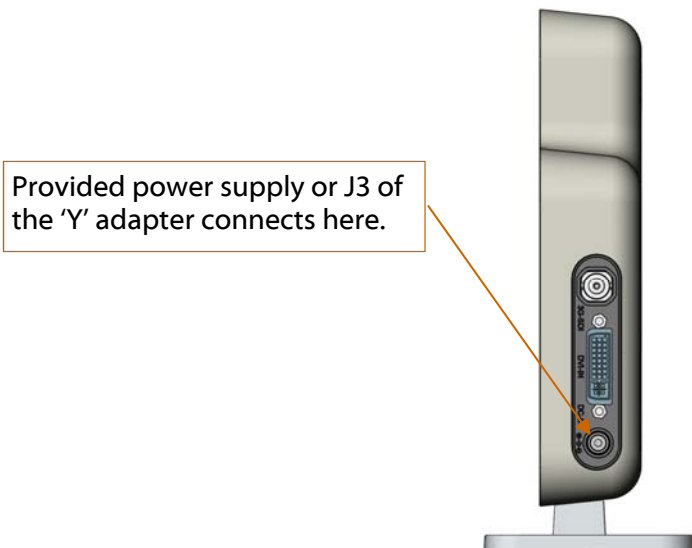
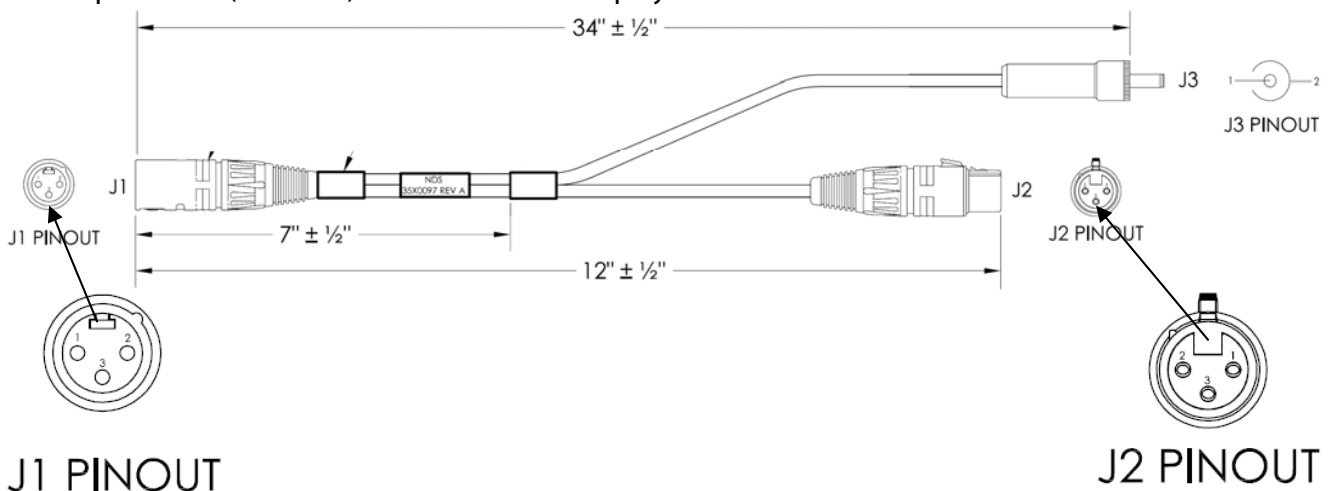
Power Options

ZeroWire transmitters and receivers may be powered from the provided power supply (pictured below), or when used with an NDS display they may be powered from the display's power supply via the supplied 'Y' adapter cable. 'Y' adapter cables, shown below, are available for Radiance 19", 24", 26" and 32" displays and Endovue 24" display. 'Y' adapter cables are not available for 37", 42", 52" or 55" Radiance displays.

'Y' adapter cable (35X0096) for 19", 24" and 26" Radiance Displays and 24" EndoVue Display



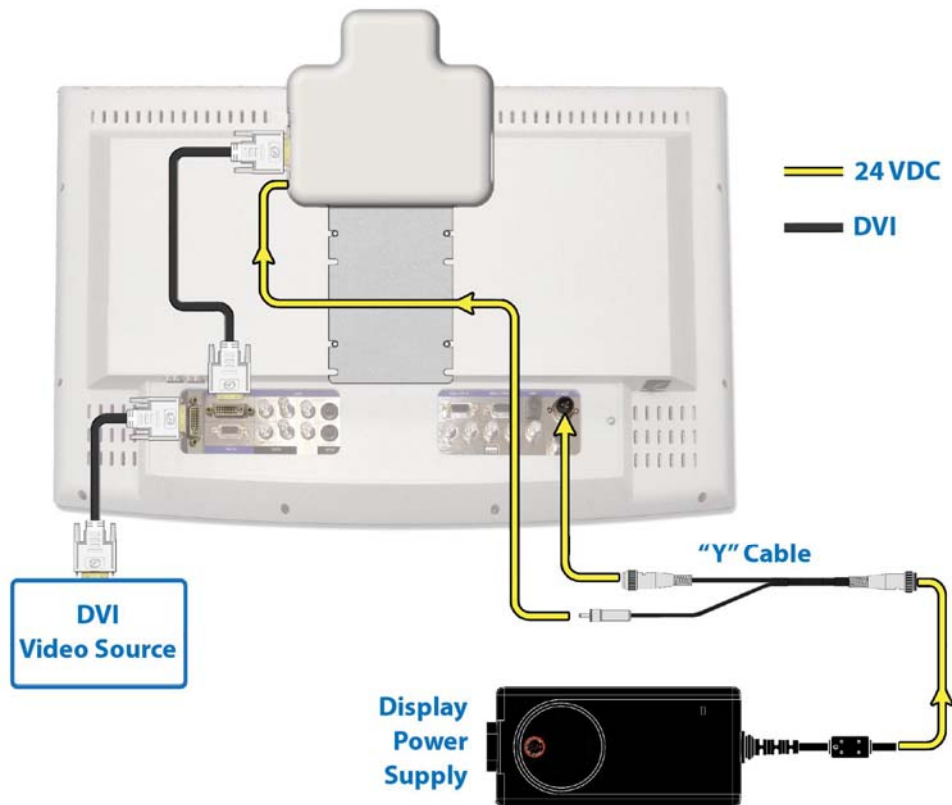
'Y' adapter cable (35X0097) for 32" Radiance Display



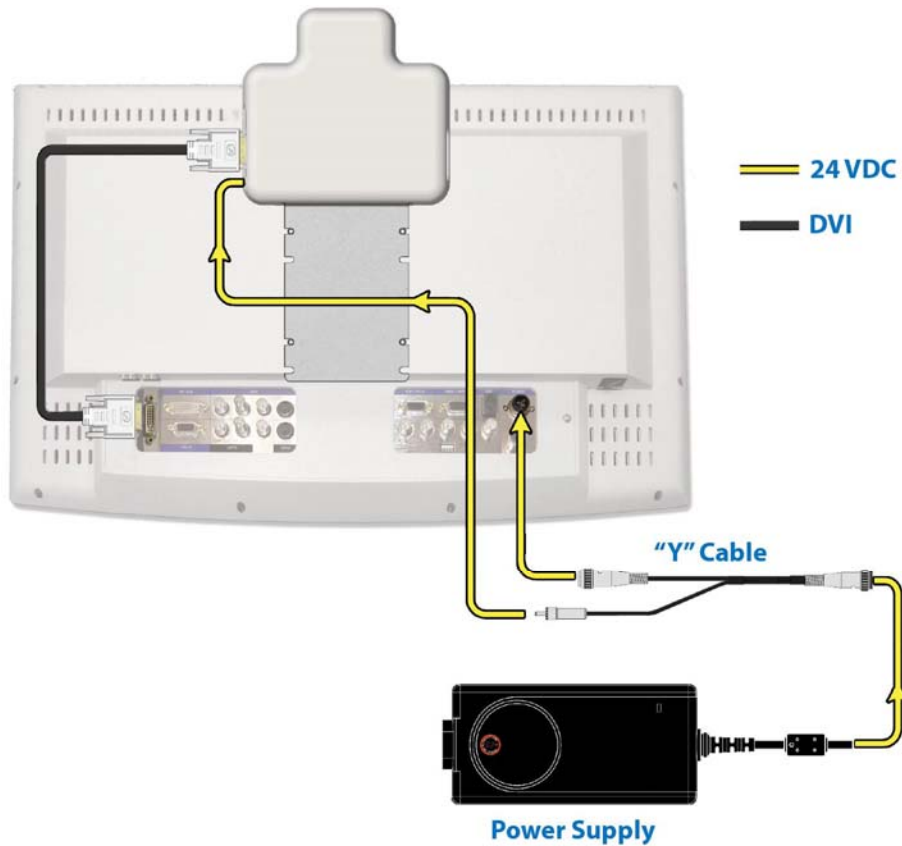
When using the included power supply, select and install the plug adapter that matches the wall socket in your OR.



Display Mounted Tx Wiring Diagram



Display Mounted Rx Wiring diagram



Setup

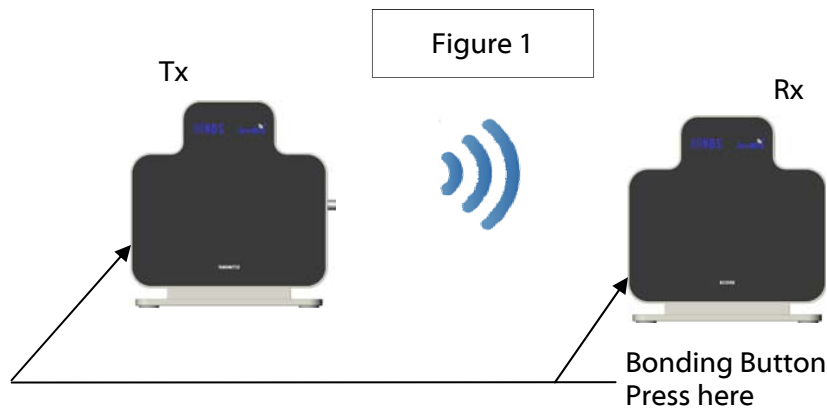
Bonding the Transmitter (Tx) and Receiver (Rx)

Before the ZeroWire wireless system can be put into service, the Tx and Rx pair must be bonded. Connect an included power supply or a 'Y' Adapter cable to a Tx and an Rx unit. See page 6 for Power Connector location and 'Y' Adapter cable information.

The status indicator LED of each unit should be yellow and blinking slowly. If the LED's are steady yellow then the Tx and Rx pair is already bonded, continue at the Passing Video section below.

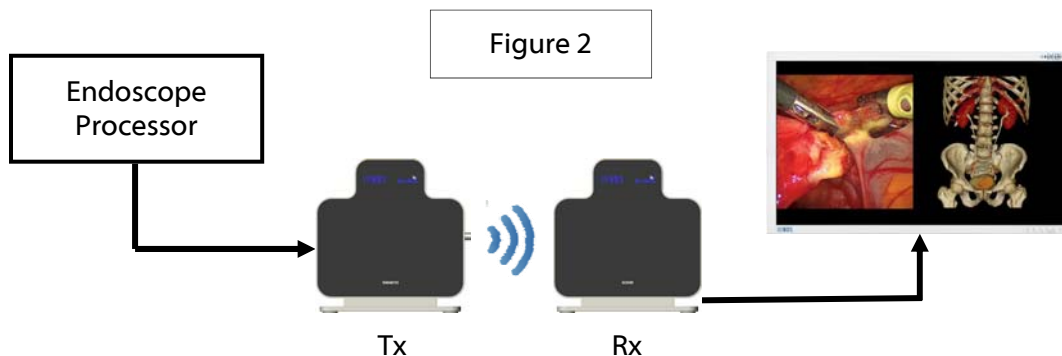
Bonding Procedure:

1. If the Tx's LED is alternating between blue and yellow, then all ZeroWire channels are in use. See page 9 for details.
2. Press and hold the "bond" button (see Figure 1 for location) on the Tx unit until its LED begins flashing rapidly, then release. Next press and hold the "bond" button (see Figure 1 for location) on the Rx unit until its LED begins flashing rapidly, then release.
3. When the bonding process is complete each unit's LED will be steady yellow.



Passing Video:

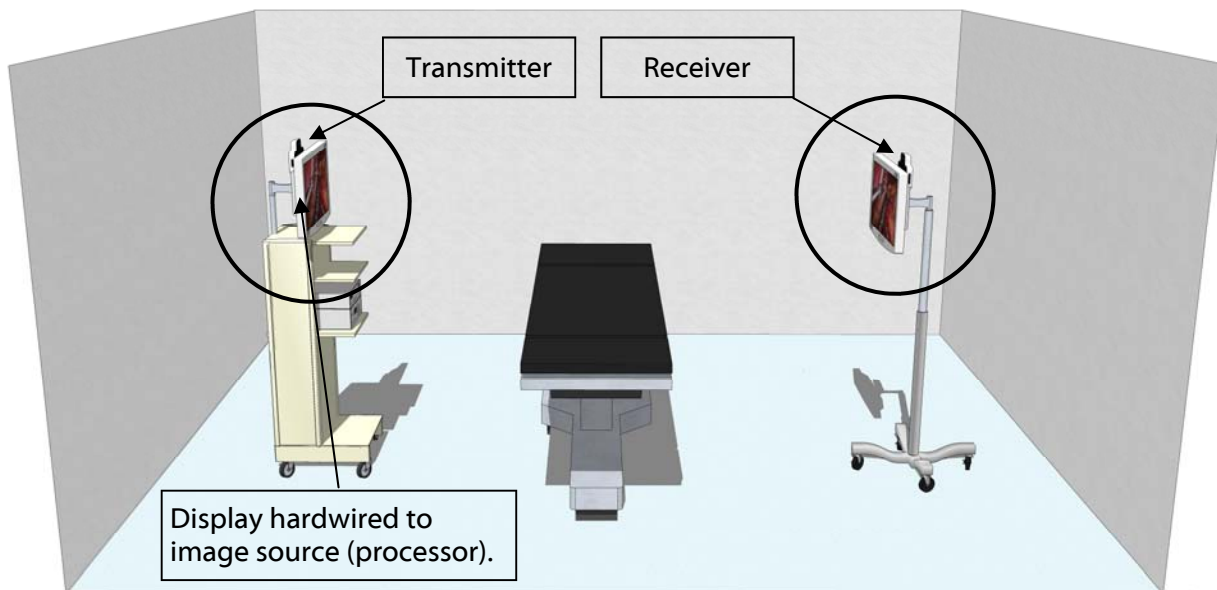
With the bonding completed, connect a DVI or SDI video source to the Tx unit and a display to the Rx unit via its DVI output (Figure 2). The indicator LED's should turn blue and the source image should appear on the display. This completes the basic setup.



Note:

The transmitter and receiver are not limited to line-of-sight operation, i.e., the pair will operate reliably despite the presence of intervening obstacles. However, neither unit should be completely surrounded by metallic objects.

Typical Installation



NDSsi recommends ZeroWire for primary and secondary displays. However, for patient safety a display that is cable connected to the video source shall be immediately available whenever a surgical procedure is in progress.

All Channels In Use Indication

Tx Indication:

1. When all channels are in use and a new ZeroWire pair or a new Tx is turned on: The LED on the Tx will alternate between blue and yellow continuously or until it finds a free channel. If a free channel is found, then the LED will behave as described in Bonding Procedure on page 8.
2. When all channels are in use and the bonding button is pressed on a new Tx. The LED on the Tx blinks fast yellow, indicating that the device is attempting to bond. If no channel is found, then the LED blinks alternately until the bonding times out. If an available channel is found, then the LED will behave as described in Bonding Procedure on page 8.

Rx Indication:

Rx is not aware that all channels are in use.

Performance

Performance:

ZeroWire HD Wireless Video System products are intended and optimized for use in a surgical operating room (OR). Use outside of an OR environment is not recommended.

The following steps will help you to achieve optimal performance of the ZeroWire system:

1. Mount both components at least 1.5 meters (5 feet) from the floor.
2. Ideally, both the transmitter and receiver should be at the same height.
3. For a reliable video link, the distance between transmitter and receiver should be 10 meters (30 feet) or less .
4. The black surfaces of the transmitter and receiver should be vertical, facing each other and be visible to each other in free air space. We do not recommend orienting the modules horizontally.
5. For non line of sight applications, we recommend that the Tx and Rx be located no more than 6 feet (2 meters) from the walls of the OR.

Multi System Installation

Multiple Systems:

When two or three systems are installed in a given OR if the Tx and Rx units have not been bonded apply power to one Tx and one Rx then follow the Bonding Procedure described on page 8. Turn second Tx and Rx pair on and repeat the Bonding Procedure. Turn on the third pair and repeat the Bonding Procedure. Tx and Rx pairs must be bonded one pair at a time. We recommend that bonded pairs be labeled to facilitate installation and troubleshooting.

ZeroWire transmitters should be separated by at least 0.5 meters (20 inches). ZeroWire transmitters (Tx) or receivers (Rx) should not be installed in metal cabinets or surrounded by metallic objects, as this will prevent the Tx from communicating with the Rx.

Note:

1. ZeroWire has three channels, therefore no more than three Tx / Rx pairs can be installed in an OR.
2. To re-use a given frequency channel, NDS recommends a minimum distance of 75 feet (23 m) between systems. For additional information refer to Advanced Features on page 11.

Multi Room Performance

Same Channel Reuse:

A given channel may be used in multiple OR's provided that the separation between systems is great enough that the Rx of one system does not detect the Tx of another system (crosstalk). The likelihood of crosstalk occurring is greatly reduced or eliminated by obstacles such as:

1. A wall separating the rooms.
2. Materials the wall is constructed from and its thickness.
3. Finish applied to the wall.
4. Metallic pipes routed inside the wall.



Operation of a given ZeroWire system for room to room communications is not recommended and not supported.

Advanced Features

Overview:

The [Update Channel / Power Utility](#)* software allows the user to configure some of **ZeroWire** transmitter and receiver parameters. The parameter settings are discussed in the following paragraphs.

Channel Selection (Tx only):

This feature allows the user to “lock” a Tx to one of the 3 available channels or allow [Auto Channel](#) selection. Auto Channel is the default.

ATPC Selection (Tx & Rx):

[ATPC](#) increases or decreases a Tx’s power when OR equipment is moved and the distance between the Tx and the Rx is changed. If [ATPC](#) is turned off the Tx’s power is set to maximum. The parameter may be turned **ON** or **OFF** to enable or disable [ATPC](#). The default is **ON**.

Deep Sleep Selection (Tx only):

When a surgical procedure is completed and the Rx turned off for a period of 3 minutes or longer, the Tx goes into [Deep Sleep Mode](#). This frees the Tx’s frequency channel for use by another [ZeroWire](#) system. Recovery from deep sleep requires momentarily pressing the Tx’s Bond button. See Bonding Procedure on page 8. [Deep Sleep](#) prevents unused **ZeroWire** transmitters from unnecessarily occupying a frequency channel. The parameter may be turned **ON** or **OFF** to enable or disable [Deep Sleep](#). The default is **ON**.

* **Note:**

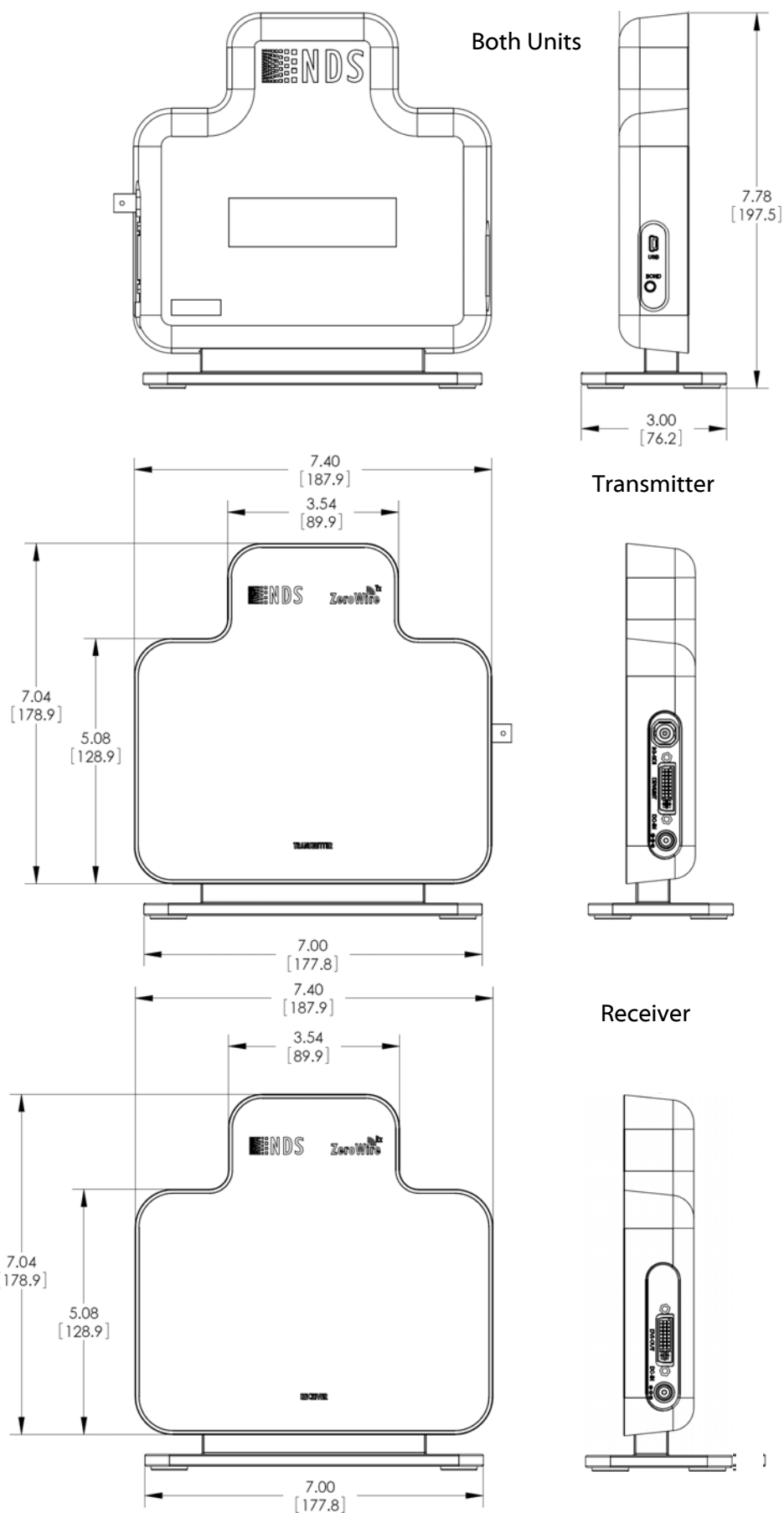
The [Update Channel / Power Utility](#) software and its usage instructions are on the CD included in the ZeroWire shipping box.

Troubleshooting

Problem	Possible Causes
Indicator LED is not on.	<p><u>Loose Power Connector:</u> Verify that the power source connector is fully inserted into the unit's power connector.</p> <p><u>'Y' Cable:</u> If you are using the 'Y' cable to supply power to the unit, confirm that it is connected to a power supply and that the power supply is energized.</p> <p><u>Stand Alone Power Supply:</u> If the stand alone power supply is being used confirm that it is fully inserted into the wall socket.</p> <p><u>Wall Socket:</u> Some wall sockets have on / off switches built in. If the socket you are using has a built in switch, check that is in the on position.</p> <p><u>Additional Information:</u> See Power Options on page 6.</p>
No video, intermittent video or poor quality video displayed.	This problem has a number of causes. The most likely of which are shown in the table below.
Cause	Remedial Action
Tx and RX are spaced more than 10 meters (30 feet) apart.	Reduce the spacing between the Tx and Rx to 10 meters (30 feet) or less. See Tx to Rx Range specification on page 13.
Tx and Rx are not aligned properly	See Performance section on page 9.
DVI or SDI (Tx only) connections	Confirm that the cables are properly connected.
Unsupported video mode	Verify that the applied video mode is supported. See the Supported Video Modes table on page 14.
DVI or SDI (Tx only) cables	Replace the cables one at a time and check the video display. If the video signal displays properly after a cable is replaced, discard the cable you just replaced.
Crosstalk	See page 10

LED Indicators

LED State	Description
Yellow and blinking slowly	The unit is not bonded. See Bonding Procedure on page 8.
Yellow and flashing rapidly	Unit is attempting to bond. See Bonding Procedure on page 8.
Yellow and steady	Unit is bonded and communicating with another unit. See page 8.
Blue and steady	The unit is sending (Tx) or receiving (Rx) video data.
Blue and blinking slowly	The source is sending an encrypted signal. Encrypted signals are copyrighted and may not be re-transmitted.
Alternating Blue and Yellow	All channels are in use. This state applies to transmitters only. See page 9.



Specifications

Wireless Signal Type	Ultra Wideband (UWB)
Frequency Band	3.1 to 4.8 GHz
RF Power Out (maximum)	-41.25 dBm / MHz
Tx to Rx Range (Line of sight not required)	Up to 30 ft (9.14m) ¹
Data Rate	53.3 to 480 Mbps
System Latency	< 1 frame
Compression Technology	H.264 Super Low Latency Technology™ ²
Hardware Encryption	128 bit AES
Video Inputs (Transmitter)	DVI, 3G SDI , HD-SDI and SDI
Video Outputs (Receiver)	DVI
Power Consumption	14 Watts (Max)
DC Power Supply	100-240VAC 50/60Hz input 24V @ .75A DC (18 watts) output
Physical Dimensions	7.04" x 7.40" x 1.43" (178.9mm x187.9mm x 36.4mm)
ZeroWire Weight (Tx or Rx) excluding base	1.4 lbs (0.64 Kg)
Mounting Base Weight	0.8 lbs (0.36 Kg)
Operating Temperature	32° to 104° F (0° to 40° C)
Operating Humidity	10% to 80% RH, non-condensing
Storage Temperature	32° to 122° F (0° to 50° C)
Storage Humidity	< 70% RH (non-condensing)

1. The effective range may vary depending upon the environment in which the product is operating. Follow the product's Setup section to achieve optimum performance and range.
2. Super Low Latency Technology is a trademark of Cavium Networks, Inc.

Supported Video Modes

Name	Horiz Active	Horiz Total	Vert Active	Vert Total
1080p/60	1920	2200	1080	1125
1080p/50	1920	2640	1080	1125
1080p/30	1920	2200	1080	1125
1080p/25	1920	2640	1080	1125
1080i/60	1920	2200	1080	562
1080i/50	1920	2640	1080	562
1280x1024/60	1280	1688	1024	1066
1280x960/60	1280	1576	960	1000
1024x768/60	1024	1344	768	806
720p/60	1280	1650	720	750
720p/50	1280	1980	720	750
480p/60	720	870	480	525
576p/50	720	864	576	625
VGA(SMT0660)	640	800	480	525
SVGA(DMT0860)	800	1056	600	628
XGA(DMT1060)	1024	1344	768	806
SXGA(DMT1260G)	1280	1688	1024	1066
NTSC	720	858	480	262
PAL	720	864	576	312
Custom Mode	1440	1904	900	932
Custom Mode	1024	1124	1024	1068
Custom Mode	1024	1152	1024	1250

Cleaning Instructions



We recommend turning the device off prior to cleaning.

Follow your organization's protocol for the handling of blood and body fluids. Clean the device with a diluted mixture of mild detergent and water. Use a soft towel or swab. Use of certain cleaning agents may cause degradation to the plastic enclosure and labels of the product. The plastic is ABS. Consult the cleanser manufacturer to see if agent used for cleaning is compatible with ABS. Do not allow liquid to enter the device.

Optional Accessories

Part Number	Description	See Page
20C0660	VESA Mount Bracket for 24" and 26" Radiance Displays	3
20C0683	VESA Mount Bracket for 19" and 23" Radiance Displays and 24" EndoVue Display	3
20C0684	Top Mount Bracket for Radiance 32" and 37" Radiance Displays	4
20C0668	Top Mount Bracket for Radiance 42", 52" and 55" Radiance Displays	4
26B0099	Spare Table Stands	5
30B0038	Spare Power Supply	6
35X0096	'Y' Adapter Cable for 19", 24" and 26" Radiance Displays and 24" EndoVue Display	6
35X0097	'Y' Adapter Cable for 32" Radiance Display	6
35D0073	6ft DVI Cable	
35D0081	6ft 3G-SDI Cable	
35D0091	Spare 3ft DVI Cable	
35D0092	Spare 2ft DVI Cable	
35D0093	Spare 3ft SDI Cable	
60A0374	Printed ZeroWire Users Manual	
Contact NDS Sales for price and availability. Contact information is on the back cover.		

Optional Accessory Kits

Part Number	Description and Contents	
90Z0118	Packaged ZeroWire Accessory Kit for 24" and 26" NDS displays	Qty
	20C0660 VESA Mounting Brackets	2
	35X0096 'Y' Adapter Cable	2
	3ft (0.91m) DVI Cable	2
	3ft (0.91m) SDI Cable	1
90Z0119	Packaged ZeroWire Accessory Kit for 32" and 37" NDS displays	Qty
	20C0684 Top Mount Bracket for Radiance 32" and 37" Radiance Displays	2
	35X0097 'Y' Adapter Cable	2
	3ft (0.91m) DVI Cable	2
	3ft (0.91m) SDI Cable	1
90Z0120	Packaged ZeroWire Accessory Kit for 42", 52" and 55" NDS displays	Qty
	20C0668 Top Mount Bracket for Radiance 42", 52" and 55" Radiance Displays	2
	3ft (0.91m) DVI Cable	2
	3ft (0.91m) SDI Cable	1
90Z0121	Packaged ZeroWire Accessory Kit for 19" and 23" Radiance and 24" EndoVue displays	Qty
	20C0683 VESA Mounting Brackets	2
	35X0096 'Y' Adapter Cable	2
	3ft (0.91m) DVI Cable	2
	3ft (0.91m) SDI Cable	1
Contact NDS Sales for price and availability. Contact information is on the back cover.		



Electromagnetic Compatibility

ZeroWire has been tested in an OR environment and did not interfere with electrosurgical, ultrasound, X-Ray, medical displays and life monitoring equipment. Neither did the aforementioned equipment interfere with ZeroWire. Additionally, since ZeroWire operates in 3.1 – 4.8 GHz, typically wireless LAN and mobile phones will not cause interference as they operate outside the ZeroWire frequency range. However, the presence of a source of interference within ZeroWire frequency range may result in intermittent operation and reduced image quality or the link could go down while the interference exists. Prior to any procedure in the OR, it is required that any such equipment be turned off and verify that the system operates as expected. If any anomalous behavior is observed, it must be corrected prior to using the system in any surgical procedures.

ZeroWire transmitters should be separated by at least 0.5 meters (20 inches). ZeroWire transmitters (Tx) or receivers (Rx) should not be installed in metal cabinets or surrounded by metallic objects, as this will prevent the Tx from communicating with the Rx.

During installation the ZeroWire link video quality should be tested with the transmitter at different orientation angles and mounting locations. This is required if the placement of the ZeroWire components deviates from the recommended guidelines on page 9 of this manual or when they must be adjacent to or stacked below other equipment. We recommend that the system be thoroughly tested prior to using it in any surgical procedures.

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Do not use power supplies or cable accessories with the ZeroWire other than those specified in this manual. Excessive leakage currents, elevated electromagnetic emissions, or insufficient interference immunity may occur.

All medical electronic devices, including ZeroWire, must conform to the requirements of IEC 60601-1-2. Precautions, adherences to the EMC guideline information provided in this manual and verification of all medical devices in simultaneous operation are required to ensure the electromagnetic compatibility and co-existence of all other medical devices prior to a surgical procedure.

The EMC tables on pages 17 and 18 are provided for your reference.

Table 200				
Cable Type	Description	Length (m)	Shielded	Ferrite
Power	Hospital Grade UL/CSA/TUV Approved	3.0	No	No
Video	Male to Male SXGA	3.0	Yes	Yes
Video	S-Video	3.7	Yes	No
Video	HD15(M) - 5 BNC(F)	0.3	Yes	No
Video	DVI-D Single Link	3.0	Yes	Yes

Table 201		
Guidance and manufacturer's declaration – electromagnetic emissions		
Emissions test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	This device uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	This device is suitable for use in all establishments other than domestic and those directly connected to the public low voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	

Table 202		
Guidance and manufacturer's declaration – electromagnetic immunity		
Immunity test	EN IEC 60601 test level	Compliance level
Electrostatic Discharge (ESD)	± 4 kV contact	Complies
IEC 61000-4-2	± 8 kV air	± 4 kV contact
		± 8 kV air
Electrical fast transient/burst	± 2 kV for power supply lines	Complies
IEC 61000-4-4	± 1 kV for input/output lines	± 2 kV for power supply lines
		± 1 kV for input/output lines
Surge	± 1 kV differential mode	Complies
IEC 61000-4-5	± 2 kV common mode	± 1 kV differential mode
		± 2 kV common mode
Voltage dips, short interruptions and voltage variations on power supply input lines	<5% U_T * (>95% dip in U_T) for 0.5 cycle	Complies <5% U_T * (>95% dip in U_T) for 0.5 cycle
IEC 61000-4-11	40% U_T (60% dip in U_T) for 5 cycles	Complies 40% U_T (60% dip in U_T) for 5 cycles
	70% U_T (30% dip in U_T) for 25 cycles	Complies 70% U_T (30% dip in U_T) for 25 cycles
	<5% U_T (>95% dip in U_T) for 5 sec	Complies <5% U_T (>95% dip in U_T) for 5 sec
Power frequency (50/60 Hz) magnetic field	3A/m	Complies 3A/m
IEC 61000-4-8		Complies

* Note: U_T is the a.c. mains voltage prior to application of the test level.


Table 204 Guidance and manufacturer's declaration – electromagnetic immunity – for equipment and systems that are not life-supporting			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Conducted RF IEC 61000-4-6 Radiated RF IEC 61000-4-3	3 V _{rms} 150 kHz to < 80 MHz 3 V/m 80 MHz to 2.5 GHz	3 volts 3 V/m	<p>Portable and mobile RF communications equipment should be used no closer to any part of the device, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance:</p> $d = \left[\frac{3.5}{3} \right] \sqrt{P}$ 150 kHz to < 80 MHz $d = \left[\frac{3.5}{3} \right] \sqrt{P}$ 80 MHz to < 800 MHz $d = \left[\frac{7}{3} \right] \sqrt{P}$ 800 MHz to 2.5 GHz <p>Where P is the maximum output power rating of the transmitter in watts [W] according to the transmitter manufacturer and d is the recommended separation in meters [m]. Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey^a, should be less than the compliance level in each frequency range^b. Interference may occur in the vicinity of equipment marked with the following symbol:</p> 
Note: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection by structures, objects and people.			
<p>a Field strengths from fixed transmitters, such as base stations for radio [cellular/cordless] telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the unit is used exceeds the applicable RF compliance level above, the unit should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the unit.</p> <p>b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.</p>			

Table 206 Recommended separation distances between portable and mobile RF communications equipment and the display.			
	Separation distance d [m] according to frequency of transmitter		
Rated maximum output power of transmitter [W]	150 kHz to < 80 MHz	80 MHz to < 800 MHz	800 MHz to 2.5 GHz
	$d = \left[\frac{3.5}{3} \right] \sqrt{P}$	$d = \left[\frac{3.5}{3} \right] \sqrt{P}$	$d = \left[\frac{7}{3} \right] \sqrt{P}$
0.0	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1.0	1.2	1.2	2.3
10.0	3.8	3.8	7.3
100.0	12	12	23

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